

**WHAT IS CLAIMED IS:**

1           1 A method of routing alarm signals in a signaling server  
2           2 disposed in a telecommunications network, said signaling server  
3           3 including a plurality of cards organized into multiple stages having a tree  
4           4 configuration, comprising the steps of:  
5           5           generating alarm data by cards disposed at a select stage in  
6           6           said tree configuration;  
7           7           transmitting said alarm data by said cards to cards disposed  
8           8           at a subsequent stage in said tree configuration;  
9           9           multiplexing, by said cards disposed at said subsequent  
10          10          stage, said alarm data into a serial bitstream having multiple frames by  
11          11          allotting predetermined time slots; and  
12          12          forwarding said serial bitstream, by each of said cards  
13          13          disposed at said subsequent stage, through said tree configuration for  
14          14          successively multiplexing said serial bitstreams into a single multiplexed  
15          15          bitstream at a trunk of said tree configuration.

1           2. The method of routing alarm signals in a signaling server  
2 disposed in a telecommunications network as set forth in claim 1, further  
3 comprising the step of inserting, by said cards disposed at said  
4 subsequent stage, alarm data pertaining to said cards disposed at said  
5 subsequent stage into said serial bitstream.

1           3. The method of routing alarm signals in a signaling server  
2 disposed in a telecommunications network as set forth in claim 2, further  
3 comprising the step of providing said single multiplexed bitstream to a  
4 controller controlling said tree configuration.

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4. The method of routing alarm signals in a signaling server  
disposed in a telecommunications network as set forth in claim 3,  
wherein said controller comprises a system timing generator, and further  
wherein said tree configuration comprises at least one clock distribution  
module card coupled to a plurality of bus control module cards, each bus  
control module card interfacing with at least one line interface card.

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5. The method of routing alarm signals in a signaling server  
disposed in a telecommunications network as set forth in claim 4,  
wherein each of said clock distribution module cards and bus control  
module cards is provided with an ID code in a serial framed control  
signal generated by said system timing generator, said ID codes  
facilitating said step of multiplexing by said clock distribution modules.

1           6. An apparatus for collecting alarm signals in a signaling  
2 server disposed in a telecommunications network, comprising:  
3                 a system timing generator including circuitry for producing  
4 a serial control signal;  
5                 a plurality of clock distribution modules organized into at  
6 least one level in a nested hierarchy coupled to said system timing  
7 generator;  
8                 a plurality of bus control modules coupled to said at least  
9 one level of clock distribution modules in said nested hierarchy, each bus  
10 control module interfacing with a plurality of printed board assembly  
11 (PBA) cards disposed on a bus segment, wherein each bus control  
12 module generates a status signal encoded with alarm data towards said  
13 at least one level of clock distribution modules; and  
14                 multiplexing circuitry in each clock distribution module to  
15 multiplex status signals received from one of a lower level in said nested  
16 hierarchy and said plurality of bus control modules into a serial bitstream  
17 having multiple frames by assigning predetermined time slots to said  
18 alarm data based on control information provided in said serial control  
19 signal.

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1           7. The apparatus for collecting alarm signals in a signaling  
2 server disposed in a telecommunications network as set forth in claim 6,  
3 further comprising means in each clock distribution module for inserting  
4 its own alarm data into said serial bitstream based on said control  
5 information provided in said serial control signal.

1           8. The apparatus for collecting alarm signals in a signaling  
2 server disposed in a telecommunications network as set forth in claim 7,  
3 wherein said system timing generator comprises clock circuitry to  
4 produce a system time clock based on a reference input of a  
5 predetermined frequency.

1           9. The apparatus for collecting alarm signals in a signaling  
2 server disposed in a telecommunications network as set forth in claim 8,  
3 wherein said bus segment comprises a Compact Peripheral Component  
4 Interconnect (CPCI) bus segment.

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1           10. The apparatus for collecting alarm signals in a signaling  
2 server disposed in a telecommunications network as set forth in claim 8,  
3 wherein said reference input comprises a derived clock signal generated  
4 from a telecommunications signal received at one of said PBA cards.

1           11. The apparatus for collecting alarm signals in a signaling  
2 server disposed in a telecommunications network as set forth in claim 8,  
3 wherein said serial control signal comprises a framed bitstream.

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1           12. An alarm collection method using a multi-stage clock  
2 distribution system in a signaling server organized in a plurality of racks,  
3 each rack including a plurality of shelves, said clock distribution system  
4 having a system timing generator, at least one clock distribution module,  
5 and a plurality of bus control modules, each bus control module  
6 interfacing with at least a portion of line cards disposed in a shelf, said  
7 method comprising the steps of:

8                 determining the size of said signaling server by ascertaining  
9 the number of racks and assigning levels to said clock distribution  
10 modules in a nested hierarchy based on said determination;

11                 assigning unique IDs to said shelves;

12                 generating, by said system timing generator, a framed serial  
13 control signal containing unique shelf ID information and clock  
14 distribution module level information;

15                 generating, by each bus control module, a status signal  
16 encoded with alarm data; and

17                 successively multiplexing said status signal towards said  
18 system timing generator through said nested hierarchy of clock  
19 distribution modules into a serial bitstream having multiple frames by  
20 assigning predetermined time slots to said alarm data by each clock

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21 distribution module based on control and ID information provided in said  
22 framed serial control signal.

1           13. The alarm collection method using a multi-stage clock  
2 distribution system in a signaling server as set forth in claim 12, wherein  
3 said step of assigning levels to said clock distribution modules comprises  
4 the steps of:

5                 if said signaling server includes more than 8 racks, writing  
6 a first level code into a select field of said framed serial control signal by  
7 said system timing generator;

8                 transmitting said framed serial control signal to a  
9 clock distribution module coupled to said system timing generator;

10                 upon reading said first level code, assuming a Central  
11 Level by said clock distribution module coupled to said system timing  
12 generator and thereby becoming a C-Level clock distribution module;

13                 changing said first level code into a second level code  
14 by said C-Level clock distribution module in said select field of said  
15 framed serial control signal;

16                 transmitting said framed serial control signal to a  
17 clock distribution module coupled to said C-Level clock distribution  
18 module;

19                 upon reading said second level code, assuming a Lead  
20 Level by said clock distribution module coupled to said C-Level clock

21 distribution module and thereby becoming an L-Level clock distribution  
22 module;

23 changing said second level code into a third level  
24 code by said L-Level clock distribution module in said select field of said  
25 framed serial control signal;

26 transmitting said framed serial control signal to a  
27 clock distribution module coupled to said L-Level clock distribution  
28 module;

29 upon reading said third level code, assuming a Rack  
30 Level by said clock distribution module coupled to said L-Level clock  
31 distribution module and thereby becoming an R-Level clock distribution  
32 module;

33 if said signaling server includes between 2 and 8 racks,  
34 inclusive, writing said second level code into said select field of said  
35 framed serial control signal by said system timing generator;

36 transmitting said framed serial control signal to said  
37 clock distribution module coupled to said system timing generator;

38 upon reading said second level code, assuming said  
39 Lead Level by said clock distribution module coupled to said system  
40 timing generator and thereby becoming said L-Level clock distribution  
41 module;

42                         changing said second level code into said third level  
43         code by said L-Level clock distribution module in said select field of said  
44         framed serial control signal;

45                         transmitting said framed serial control signal to a  
46         clock distribution module coupled to said L-Level clock distribution  
47         module;

48                         upon reading said third level code, assuming a Rack  
49         Level by said clock distribution module coupled to said L-Level clock  
50         distribution module and thereby becoming an R-Level clock distribution  
51         module;

52                         if said signaling server includes a single rack, writing third  
53         level code into said select field of said framed serial control signal by  
54         said system timing generator;

55                         transmitting said framed serial control signal to said  
56         clock distribution module coupled to said system timing generator; and

57                         upon reading said third level code, assuming Rack  
58         Level by said clock distribution module coupled to said system timing  
59         generator and thereby becoming said R-Level clock distribution module.

1           14. The alarm collection method using a multi-stage clock  
2 distribution system in a signaling server as set forth in claim 13, wherein  
3 said step of assigning unique IDs to said shelves comprises the steps of:  
4                 assigning, by said system timing generator, a redundancy  
5 Plane code to said C-Level clock distribution modules in said nested  
6 hierarchy;  
7                 assigning, by said C-Level clock distribution modules, a  
8 Group code to said L-Level clock distribution modules in said nested  
9 hierarchy;  
10                 assigning, by said L-Level clock distribution modules, a  
11 Rack code to said R-Level clock distribution modules in said nested  
12 hierarchy; and  
13                 assigning, by said R-Level clock distribution modules, a  
14 Shelf code to said shelves.

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1           15. The alarm collection method using a multi-stage clock  
2 distribution system in a signaling server as set forth in claim 14, wherein  
3 said redundancy Plane code comprises a two-bit field in said framed  
4 serial control signal.

1           16. The alarm collection method using a multi-stage clock  
2 distribution system in a signaling server as set forth in claim 15, wherein  
3 each of said Group, Rack, and Shelf codes comprises a separate four-bit  
4 field in said framed serial control signal.

